BOILER EXPLOSIONS

Causes and Prevention

READING COMPANY

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In a steam locomotive boiler the transferring of heat to the water through the firebox sheets and tubes, causes steam vapor to rise and steam pressure builds up as firing continues. The boiling point of water is 212° F. at standard atmospheric pressure and when confined in a boiler at pressures ranging up to 275 lbs. the temperature of the water in boiler rises to slightly above 400° F. which is above the evaporation point. The temperature required to evaporate the water in a boiler rises as the steam pressure in the boiler increases.

The crown sheet being the highest sheet in the firebox is the first sheet to become unprotected when low water occurs and is usually the first sheet to rupture if water is not supplied the boiler at the proper level.

Numerous theories have been advanced as to what causes the boiler explosions and the violence accompanying such explosions. The true reason is easily understood when the explosion is due to low water and the explanation is as follows:—the proper water level has not been maintained and the crown sheet becomes bare of water; the heat on the firebox side causes this sheet to become red hot and soft; the sheet loses its strength and the steam pressure on the water side causes the weakened crown sheet to stretch and pull down and away from the crown bolts and radial stays; when the sheet is sufficiently hot and has stretched beyond its limit of elasticity it ruptures and releases the steam pressure from the boiler. The water in the boiler which is heated beyond the evaporation point immediately flashes into steam and expanding approximately 2000 times its volume and exerting this great force through the ruptured sheets gives the boiler a skyrocket effect, usually tearing the boiler from the frame with great violence and hurling it into the air, usually turning it end for end, causing loss of life and generally great damage.

To prevent the possibility of such a catastrophe:—

(1) Never let the water get below the bottom of the water glass or the bottom gauge cock.

(2) Immediately put injector and pump to work at full capacity if for any reason the water does get below the level of the water glass and bottom gauge cock.

(3) Dampen fire immediately, using sprinkling hose, if water does not return to water glass and gauge cocks after injector and pumps are started to work. Start dumping fire immediately after using sprinkling hose, if water has not returned to water glass and gauge cocks.

(4) Test water glass, water column, gauge cocks, injector and pump before leaving terminal and at frequent intervals between terminals. To test water glass, open drain cock, shut top valve, let blow approximately 30 seconds. Shut bottom valve, open top valve, let blow approximately 30 seconds. Open bottom valve, shut drain valve and water should return to glass immediately. To test water column, open drain cock and let water and steam blow approximately 30 seconds. Shut drain cock and water should return promptly.

(5) Use blow-off cocks in accordance with standard instructions.

(6) Make proper inspection of firebox sheets before leaving, and after arriving at terminals; reporting any defects to proper authorities.

(7) When reaching top of grades have sufficient water to protect crown sheet before starting down grade as water level drops when throttle opening is reduced. Also water in boiler surges ahead in starting down grade, reducing the amount of water covering crown sheets.

Our locomotives are equipped with the best water registering devices, as well as injectors and pumps, that are available. Our boilers are designed and maintained at the high degree of maintenance required by the Federal Inspection Law. Ninety-eight percent (98%) of the crown sheet failures that occur are due to low water, all of which could be prevented if these instructions are strictly followed.

E. P. GANGEWERE,
Superintendent Motive Power
and Rolling Equipment.

Approved:
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